

REMARKS

Claims 1, 4-13 and 60-87 are pending in the present application. In the Office Action dated November 4, 2003, the Examiner rejected claims 1, 4-7, 9-13, 60-67, 69, 70-76, 78-84, 86 and 87 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5, 961,375 to Nagahara et al. (“Nagahara”) in view of U.S. Patent No. 6,431,968 B1 to Chen *et al.* (“Chen”). The Examiner also rejected claims 8, 68, 77 and 85 under 35 U.S.C. 103(a) as being unpatentable over Nagahara in view of Chen and further in view of U.S. Patent No. 6,022,268 to Roberts *et al.* (“Roberts”). Applicants disagree with these rejections and wish to clarify various distinctions of applicants’ invention over the cited art. Reconsideration of the invention is therefore requested in light of the following remarks.

In the remarks that follow, various technical differences between the references cited by the Examiner and the embodiments of the present invention are discussed. It is understood, however, that any discussion involving various embodiments of the invention, which are disclosed in detail in the applicant’s specification, do not define the scope or interpretation of any of the claims. Moreover, any discussion of differences between the references cited and the various embodiments of the invention are intended only to help the Examiner to appreciate the importance of the claimed distinctions as they are discussed.

As a preliminary matter, applicant notes that, to date, the PTO-1449 from the Supplemental Information Disclosure Statement filed on February 21, 2003 has not been returned. The Examiner is kindly requested to examine the PTO-1449, initial the references, sign the document and return the document to the undersigned attorney.

The disclosed invention is directed towards methods and apparatuses for planarizing microelectronic substrates. In a pertinent embodiment of the disclosed invention, as shown in Figure 6 of the present application, a membrane 250 is positioned within a substrate holder 231 that retains a substrate 112 while the substrate is planarized. The membrane 250 includes a peripheral portion 251 that may have a thickness greater than the central portion 252. Alternatively, the peripheral portion 251 may have a thickness that is thinner than the central portion 252. The membrane 250 may be fabricated from a generally flexible, compressible solid

material, as shown in Figure 6, which may be comprised of neoprene or a silicone rubber, although other resilient, flexible and compressible materials may be used.

When the substrate 112 is undergoing planarization, the thicker portions of the membrane 250 correspondingly exert a greater force on portions of the substrate 112 that *directly* contact the thicker portions of the membrane 250. Consequently, the portions of the substrate 112 subjected to the greater normal force are planarized at a greater rate than the portions of the substrate 112 that are in facial contact with the thinner portions of the membrane 250. In particular, when the thicker portions of the membrane 250 are positioned in the peripheral portion 251 of the membrane 250, substrates 112 having features toward the periphery of the substrate 112 that require higher planarization rates are more effectively planarized since the additional normal force presented by the peripheral portion 251 allows the substrate periphery to be planarized at a greater rate than is achievable by the greater linear velocity at the periphery of the substrate 112 alone.

The Examiner has cited the Nagahara reference for disclosing a substrate holder assembly for retaining a substrate during planarization. With reference now to Figure 2A, the substrate holder includes a rigid backing plate 104 having a recessed contact surface 105 disposed in the backing plate 104. The contact surface 105 abuts a shim 110 that has a curved surface that presses a substrate 20 onto a polishing pad 22. A carrier film 108 is positioned between the substrate 20 and the curved surface of the shim 110. The carrier film 108 “may be made from a flexible material...” (col. 5, lines 54-56). The carrier film 108 thus forms a flexible interface between the non-compressible shim 110 and the substrate 20.

Additionally, the carrier film 108 “may...include...an adhesive backing...that ensures adhesion of the carrier film to the shim 110.” (col. 6, lines 30-35). The adhesive nature of the carrier film 108 also serves other important functions in connection with the disclosed invention. For example, the carrier film 108 “adheres to those portions of the contact surface that are not adjacent shims...and facilitates in securing shims...to backing plate 204” (col. 7, lines 8-12). When the shims are relatively thin, “carrier film adhering to portions of contact surface that does not have any shims further reinforces the shim positions.” (col. 7, lines 32-34).

Accordingly, the applicant understands the carrier film 108 to be a necessary and integral portion of the disclosed invention that forms a flexible interface between the substrate

and the shim, that also adheres the shims to the contact surface in cases where multiple shims are used, and also in cases where the shim is relatively thin. In contrast, the various embodiments do not rely on the presence of a carrier film. Instead, the relatively compliant and compressible membrane directly contacts the substrate as it is planarized.

The Examiner has also cited the Chen reference for disclosing a relatively flexible membrane of uniform thickness that is positioned on a carrier head. The Examiner urges that the disclosed membrane provides the teaching missing from the Nagahara reference. The applicant respectfully disagrees. If the shims and/or backing plate of Nagahara are replaced with a relatively compliant material, *it would render the carrier film unnecessary*. Applicant therefore respectfully asserts that the cited art, when considered in its entirety, is devoid of the requisite motivation to combine the references, since the proposed combination would render an integral part (the carrier film) unnecessary.

The Examiner has also cited the Roberts reference. Roberts is cited for teaching an injection molding process for forming a silicone rubber polishing pad. Roberts, however, does not rectify the shortcomings present in the asserted combination of Nagahara and Chen.

Turning now to the claims, patentable differences between the claim language and the applied references will be specifically pointed out. Claim 1, as amended, recites in pertinent part: “A carrier for supporting a microelectronic substrate relative to a planarizing medium during planarization of the microelectronic substrate, the carrier comprising...a support member...and...*a flexible, compressible membrane adjacent to the support member*, the membrane having a first portion with a first thickness and a second portion with a second thickness greater than the first thickness, the first portion of the membrane being aligned with a first part of the microelectronic substrate when the membrane engages the microelectronic substrate, the second portion of the membrane being aligned with a second part of the microelectronic substrate when the membrane engages the microelectronic substrate, *the substrate directly contacting the membrane...*” (Emphasis added). The asserted combination does not disclose this or fairly suggest this, as addressed in detail above. Claim 1 is therefore allowable over the cited combination. Claims depending from claim 1 are also allowable based upon the allowability of the base claim and further in view of the additional limitations present in the dependent claims.

Claim 60, as amended, recites in pertinent part, “A carrier for supporting a microelectronic substrate relative to a planarizing medium during planarization of the microelectronic substrate, the carrier comprising...a support member...and...a *flexible, compressible membrane* having an upper ply adjacent to the support member, and a lower ply depending downwardly from the upper ply, the lower ply having a first portion with a first thickness and a laterally spaced apart second portion with a second thickness greater than the first thickness, the first portion of the lower ply being aligned with a first part of the microelectronic substrate and applying a first force to the substrate when the lower ply engages the microelectronic substrate, the second portion of the lower ply being aligned with a second part of the microelectronic substrate and applying a second force different from the first force when the lower ply engages the microelectronic substrate, *the first and second portions simultaneously directly contacting the microelectronic substrate* when the lower ply engages the substrate, the substrate being held stationary relative to the membrane as the substrate is moved relative to the planarizing medium.” (Emphasis added). Again, the asserted combination simply does not disclose or fairly suggest this. Claim 60 is therefore allowable over the cited combination. Claims depending from claim 60 are also allowable based upon the allowability of the base claim and further in view of the additional limitations present in the dependent claims.

Claim 71, as amended, recites in pertinent part, “A carrier for supporting a microelectronic substrate relative to a planarizing medium during planarization of the microelectronic substrate, the carrier comprising...a support member...and...a *flexible, compressible membrane* adjacent to the support member, the membrane having a first portion with a first thickness and a laterally spaced apart second portion with a second thickness greater than the first thickness, the first portion of the membrane being configured to apply a first force to the substrate when the membrane engages the microelectronic substrate, the second portion of the membrane being configured to apply a second force to the substrate when the membrane engages the microelectronic substrate, the second force being different from the first force and the first and second portions simultaneously contacting the microelectronic substrate *when the membrane directly engages the substrate*, the substrate being held stationary relative to the membrane as the substrate is moved across the planarizing medium.” (Emphasis added). Yet again, the asserted combination simply does not disclose or fairly suggest this. Claim 71 is

therefore allowable over the cited combination. Claims depending from claim 71 are also allowable based upon the allowability of the base claim and further in view of the additional limitations present in the dependent claims.

Finally, claim 78, as amended, recites in pertinent part: “A carrier for supporting a microelectronic substrate relative to a planarizing medium during planarization of the microelectronic substrate, the carrier comprising...a support member...and...*a flexible, compressible membrane* having an upper ply adjacent to the support member, and a lower ply depending downwardly from the upper ply, the lower ply having a first portion with a first thickness and a laterally spaced apart second portion with a second thickness greater than the first thickness, the first portion of the lower ply being configured to apply a first force to the substrate when the substrate is aligned with the lower ply and the second portion being configured to apply a second force to the substrate when the substrate is aligned with the lower ply, *the first and second portions simultaneously directly contacting the substrate*, the substrate being held stationary with respect to the lower ply as the substrate is moved across the planarization medium.” (Emphasis added). The combination of Nagahara and Chen do not disclose or fairly suggest this. Claim 78 is therefore allowable over the cited combination. Claims depending from claim 78 are also allowable based upon the allowability of the base claim and further in view of the additional limitations present in the dependent claims.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a timely Notice of Allowance are earnestly solicited.

Respectfully submitted,

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